Complete Summary

GUIDELINE TITLE

Care of the patient with seizures. 2nd edition.

BIBLIOGRAPHIC SOURCE(S)

American Association of Neuroscience Nurses. Care of the patient with seizures. 2nd ed. Glenview (IL): American Association of Neuroscience Nurses; 2007. 23 p. [152 references]

GUIDELINE STATUS

This is the current release of the guideline.

** REGULATORY ALERT **

FDA WARNING/REGULATORY ALERT

Note from the National Guideline Clearinghouse: This guideline references a drug(s) for which important revised regulatory and/or warning information has been released.

- December 16, 2008 - Antiepileptic drugs: The U.S. Food and Drug Administration (FDA) has completed its analysis of reports of suicidality (suicidal behavior or ideation [thoughts]) from placebo-controlled clinical trials of drugs used to treat epilepsy, psychiatric disorders, and other conditions. Based on the outcome of this review, FDA is requiring that all manufacturers of drugs in this class include a Warning in their labeling and develop a Medication Guide to be provided to patients prescribed these drugs to inform them of the risks of suicidal thoughts or actions. FDA expects that the increased risk of suicidality is shared by all antiepileptic drugs and anticipates that the class labeling change will be applied broadly.

COMPLETE SUMMARY CONTENT

CATEGORIES
IDENTIFYING INFORMATION AND AVAILABILITY

SCOPE

DISEASE/CONDITION(S)

Seizure disorders, including epilepsy

GUIDELINE CATEGORY

Diagnosis
Evaluation
Management
Treatment

CLINICAL SPECIALTY

Critical Care
Emergency Medicine
Family Practice
Internal Medicine
Neurological Surgery
Neurology
Nursing
Obstetrics and Gynecology
Pediatrics
Physical Medicine and Rehabilitation

INTENDED USERS

Advanced Practice Nurses
Hospitals
Nurses

GUIDELINE OBJECTIVE(S)

- To assist registered nurses, patient care units, and institutions in providing safe and effective care to patients with seizures
- To provide background on the classification, epidemiology, and pathophysiology of seizure disorders, and the implications for initial and ongoing neurological assessment and management of the patient with seizures

TARGET POPULATION

Children and adults with seizure disorders

INTERVENTIONS AND PRACTICES CONSIDERED

Diagnosis/Evaluation

1. Assessment and monitoring
2. Diagnostic testing
    - Electroencephalogram
    - Magnetic resonance imaging (MRI)
    - Functional MRI
    - Magnetic resonance spectroscopy
    - Positive emission tomography
    - Single photon emissions computed tomography
    - Magnetoencephalography
    - The Wada test
    - Neuropsychological testing
    - Noninvasive and invasive monitoring procedures in the epilepsy monitoring unit

Management/Treatment

1. Antiepileptic medications
    - Drug titration
    - Drug interactions monitoring
    - Drug monitoring (drug levels, hepatic function, blood count, metabolic panel, ammonia level)
2. Surgical management (lobectomy, vagus nerve stimulator)
3. Patient and family education

MAJOR OUTCOMES CONSIDERED

- Incidence of seizures
- Incidence of seizure-related injuries
- Adverse drug effects
- Adverse effects of surgical management
- Attainment of individually-defined patient goals

METHODOLOGY

METHODS USED TO COLLECT/SELECT EVIDENCE

Hand-searches of Published Literature (Secondary Sources)
Searches of Electronic Databases

DESCRIPTION OF METHODS USED TO COLLECT/SELECT THE EVIDENCE

A review of the published literature from 1997 to 2007 was conducted using PubMed/Medline and CINAHL to search the following terms: *seizure*, *epilepsy*, and *epilepsy monitoring unit*. Monographs, textbooks, and review articles were also consulted. Studies that did not directly pertain to the topic or were not written in English were excluded from further evaluation.

NUMBER OF SOURCE DOCUMENTS

Not stated

METHODS USED TO ASSESS THE QUALITY AND STRENGTH OF THE EVIDENCE

Expert Consensus
Weighting According to a Rating Scheme (Scheme Given)

RATING SCHEME FOR THE STRENGTH OF THE EVIDENCE

Data Quality Classification

Class I: Randomized controlled trial without significant limitations or meta-analysis

Class II: Randomized controlled trial with important limitations (e.g., methodological flaws, inconsistent results); observational study (e.g., cohort, case control)

Class III: Qualitative study, case study, or series

Class IV: Evidence from reports of expert committees and/or expert opinion of the guideline panel, standards of care, and clinical protocols that have been identified

METHODS USED TO ANALYZE THE EVIDENCE

Review of Published Meta-Analyses
Systematic Review

DESCRIPTION OF THE METHODS USED TO ANALYZE THE EVIDENCE

Not stated

METHODS USED TO FORMULATE THE RECOMMENDATIONS

Expert Consensus

DESCRIPTION OF METHODS USED TO FORMULATE THE RECOMMENDATIONS

The Clinical Practice Guideline (CPG) and recommendations for practice are established based upon the evaluation of the available evidence.

RATING SCHEME FOR THE STRENGTH OF THE RECOMMENDATIONS

Levels of Recommendation

Level 1: Recommendations are supported by class I evidence.

Level 2: Recommendations are supported by class II evidence.

Level 3: Recommendations are supported by class III and class IV evidence.

COST ANALYSIS

A formal cost analysis was not performed and published cost analyses were not reviewed.

METHOD OF GUIDELINE VALIDATION

External Peer Review

DESCRIPTION OF METHOD OF GUIDELINE VALIDATION

Blinded external peer review was performed using established criteria for evaluation.

RECOMMENDATIONS

MAJOR RECOMMENDATIONS

The data quality classifications (**I-IV**) supporting the recommendations and levels of recommendation (**1-3**) are defined at the end of the "Major Recommendations" field.

Practice Pearl

Be aware of seizure classification. It is a crucial item of significance and can facilitate outcomes in patients with epilepsy (PWE).

Interventions

Assessment and Monitoring

During the ictal phase it is important to stay with the individual and provide a safe environment (Figure 1 in the original guideline document). In addition to keeping the patient safe, nurses should also observe and record the actual seizure event as it progresses. Providing information on how the seizure started, location and duration of motor activity, patient report of sensory activity, and any other pertinent details that might assist in the diagnosis of seizure type are important. Any identified aggravating or precipitating factors should also be noted (**Level 3**; Buelow et al., 2004).

Nurses should record the patient's behavior postictally. If the patient is awake, the nurse should evaluate motor strength, patient's ability to speak and remember, and orientation. This information is also important in the localization of the seizure focus (**Level 3**; Buelow et al., 2004; McQuillan, 2006).

Medical Management

Antiepileptic Medications

Treatment for patients with epilepsy typically begins with antiepileptic drug (AED) therapy. The goal of treatment is complete seizure control with no side effects. There are many factors to consider in choosing which medication(s) are prescribed to patients. The most important is the seizure type. Other factors include, but are not limited to: age, sex, long-term goals, health history, drug interactions, potential side effects, and psychological history. Prescribing medication is based on research and clinical practice. The U.S. Food and Drug Administration (FDA) has approved certain AEDs to be used for certain seizure types. The following are examples of FDA approved AEDs for seizure types:

- Carbamazepine (Tegretol, Tegretol XR, and Carbatrol): approved for partial epilepsy, primary and secondary generalized tonic-clonic (GTC) epilepsy
- Felbamate (Felbatol): approved for partial epilepsy, adjunctive therapy in refractory partial and generalized epilepsy
- Gabapentin (Neurontin): approved for partial epilepsy
- Lamotrigine (Lamictal): approved for adjunctive therapy in partial and generalized epilepsy
- Levetiracetam (Keppra): approved for partial epilepsy and myoclonic epilepsy
- Oxcarbazepine (Trileptal): approved for partial epilepsy and generalized epilepsy
- Phenobarbital: approved for partial and generalized seizures
- Phenytoin (Dilantin): approved for partial seizures, primary and secondary GTCs
- Pregabalin (Lyrica): approved for partial epilepsy
- Tiagabine (Gabitril): approved for partial and secondary generalized epilepsy
- Topiramate (Topamax): approved for partial seizures and GTCs
- Valproic acid (Depakene), divalproex sodium (Depakote, Depakote ER): approved for partial seizures, absence seizures, primary and secondary GTC, atypical absence tonic, and clonic epilepsy
- Zonisamide (Zonegran): approved for partial epilepsy (Stern, 2006)

This is not an exhaustive list of AEDs currently available for the physician or other qualified practitioner to prescribe. It is not uncommon for practitioners to prescribe AEDs thatÂ the FDA has not yet approved for certain seizure types. These situations may occur based on clinical evidence that may not have research approval. When this happens it is called prescribing AEDs "off label." Most patients with epilepsy are required to take AEDs on a long-term basis. Potential side effects and drug interactions should be considered for each epilepsy patient. For example, an overweight patient may not want to be prescribed an AED with the side effect of weight gain or a female interested in childbearing may request an AED with less teratogenic potential. It is therefore important to know your epilepsy patient's history and life goals when providing medication education and counseling (**Level 3**; Morrel, 2005; Tsur, O'Dell, & Shinnar, 2005; Willmore, Pickens, & Pellock, 2005).

Drug Titration

When physicians or other qualified practitioners prescribe AEDs, there is usually a titration process to prevent major side effects. The titration process can depend on the prescribed AED and the patient's past drug reaction history.

For example:

- AEDs that can be titrated faster than the rest of the AEDs include phenytoin, levetiracetam, and valproic acid.
- AEDs that must be titrated slower than the rest of the AEDs include lamotrigine (to prevent Stevens-Johnson syndrome) and topiramate (to prevent cognitive dysfunction).

Even when increasing the dosage of an existing AED, titration to the new dosage must occur. It is not uncommon for patients to complain of dizziness while the body adjusts to each new dosage of the AED. The dizziness should subside before the next titration occurs. If the dizziness continues, the titration process can be changed.

For example:

- Change the titration schedule from increasing the next dose every week to every other week.
- Reduce the dosage for each titration (e.g., each increase by 50 mg changes to each increase by 25 mg).

If dizziness still occurs or the patient complains of other side effects, then the practitioner may elect to prescribe another AED. When coming off of an AED, tapering needs to occur. The tapering may be faster than the titration but, if abruptly stopped without tapering, rebound seizure activity as well as status epilepticus can happen. An allergic reaction may be the only reason to abruptly stop the AED. The half-life of the AED must be kept in mind during tapering or cessation of therapy. Even though the AED may no longer be taken, it may require several more days for all of the AED to be removed from the body. Two AEDs with long half-lives are lamotrigine and zonisamide.

Drug Interactions

It is not uncommon for patients to take prescribed medication, over-the-counter (OTC) medications, herbs, and other alternative therapies in addition to AEDs. It is important for the patient to be instructed to ask at least two questions when being prescribed other medications or considering alternative therapies:

- Will the medication and/or alternative therapy interact with the prescribed AED?
- Will the medication and/or alternative therapy lower the seizure threshold?

AEDs that are mainly metabolized in the liver will potentially have a higher incidence of interaction with other medications and with alternative therapies that are also metabolized in the liver. Two of the AEDs known to affect or be affected by other medications and alternative therapies are phenytoin and carbamazepine.

Monitoring

The meaning of AED blood level results is presently a controversial issue among practitioners. However, practitioners agree on the importance of monitoring of

Hepatic Function Panels, complete blood count, basic metabolic panel, and when indicated, ammonia levels as indicators of possible side effects of therapy.

For example:

- Hepatic Function Panel results monitor the effects on liver inducer AEDs such as phenytoin; that is essential especially for felbamate. (For patients on felbamate, Hepatic Function Panel and complete blood count need to be monitored frequently, in some cases monthly.)
- Platelet count needs to be monitored while on AEDs such as valproic acid; white blood counts need to be monitored while on AEDs such as carbamazepine.
- Sodium needs to be monitored while on AEDs such as oxcarbazepine.
- Ammonia levels need to monitored while on AEDs such as valproic acid.

Monotherapy Versus Polytherapy

Monotherapy is the ideal therapy for patients with epilepsy, but there are people who need more than one drug to control their epilepsy. Physicians or other qualified providers will need to prescribe an additional AED when seizures persist. At times, even with multiple AED use, the epilepsy cannot be controlled, requiring the additional diagnosis of intractable epilepsy. The intractable patient may then undergo diagnostic testing to investigate possible surgical treatment options.

Practice Pearls

- Learn the major side effects of each AED and the half-life of various AEDs. Knowing these will help you educate the patient and family members about AED(s) the patient is prescribed.
- Identify the patient's way of learning or comprehending AED education. There are various effective methods patients can use, such as written instructions, visual pictures, handouts, use of a Palm Pilot or Blackberry, diary, and calendar. These methods need to be individualized to the patient and family situation.
- Follow up with a phone call to the patient no later than 1 week after instructions are given to assess comprehension of the plan, questions, concerns, issues, and side effects. Encourage communication between patient and healthcare professionals.
- Encourage the patient to keep a diary, spread sheet, or calendar of reactions to the AED therapy and need for follow-up laboratory testing. Remember the patient's memory and concentration may be altered, prompting many questions and concerns.
- Respond to questions regarding whether another medication (prescribed or OTC) and/or alternative medicine can interact with AEDs or lower seizure threshold. Pharmacy books like the *Physician's Desk Reference*, your facility's drug information center, the patient's own pharmacy, and the AED's pharmaceutical company are helpful places to seek correct information.

Diagnostic Tests

Diagnostic testing can assist in giving more information about the patient's epilepsy. There have been recent advances in the number of diagnostic tests, creating more options for patients with epilepsy. With these developments, physicians can better evaluate patients diagnosed with intractable epilepsy. *Intractable epilepsy* occurs in approximately 36% of PWE and is defined as persistent seizures despite adequate treatment (Kwan & Brodie, 2000). Diagnostic evaluations provide crucial information to assist with treatment options. It is quite common for physicians to order multiple tests while developing a plan of action for the patient's care. It is also not uncommon to repeat certain tests years later if the patient's epilepsy takes a turn for the worse. Clinicians should be aware that it is not uncommon for insurance companies to view new diagnostic tests for epilepsy as experimental, thus causing the patient to pay out of pocket for tests. Hospitals and insurance companies have been requesting that these tests be performed on an outpatient basis, with the exception of the epilepsy monitoring unit and ictal SPECT (single photon emissions computed tomography). The following are examples of some diagnostic tests available:

- Electroencephalogram (EEG)
- Magnetic resonance imaging (MRI)
- Magnetic resonance spectroscopy (MRS)
- Functional magnet resonance imaging (fMRI)
- Positron emissions tomography (PET)
- Ictal SPECT
- Magnetoencephalography (MEG)
- Wada test
- Neuropsychological testing
- Epilepsy monitoring unit (EMU)

EEG

The EEG is a basic noninvasive test capturing electrical changes within the brain by using scalp electrodes. These electrodes are placed in various montages using a different number of contacts. These tests can be ordered for as little as a half hour up to 23 hours, with or without a video camera for added clinical information. For monitoring greater than 23 hours, the physician would consider admission into the EMU. Care of the patient in the EMU is discussed below.

Practice Pearls

- The basic EEG is time limited and may not always capture seizure activity during a small time frame.
- Practitioners may want to consider depriving the patient of sleep prior to the EEG to increase the likelihood of capturing seizure activity.
- Patients should shampoo their hair the day of the EEG without using any other chemicals on the scalp or hair that could potentially interfere with the testing.

MRI

The MRI is a noninvasive test used to look for structural changes within the brain. There are different types of MRIs that can be used. One type is the thin-cut MRI allowing for the coronal and T2 cuts to better visualize the mesial structures of the brain in looking for hippocampal changes. There are at least three different magnets that can be used for the MRI. Two of the magnet types normally used for the MRI are the 1.5 Tesla and 2 Tesla. A patient who has a vagal nerve stimulator (VNS) can have the device turned off prior to these two magnet MRIs without damage, up to a 1.5 Tesla magnet. The device needs to be turned back on after the MRI. The 3 Tesla magnet MRI is used to visualize cortical dysplasia.

Practice Pearl

Ascertain whether the patient has a problem with enclosed spaces for up to approximately 45 minutes to 1 hour, depending on facility. This will need to be addressed and dealt with prior to the patient coming in for the MRI.

MRS

The MRS is a noninvasive test that looks at chemical changes within the brain, especially around the hippocampus. This test can be performed at the same time as the MRI (which can add approximately 15–30 minutes more, depending on the facility). Currently a number of insurance companies view the MRS as experimental for the diagnosis of epilepsy, leaving the patient to cover the expense of the test.

fMRI

The fMRI is a noninvasive test using the 3 Tesla magnet MRI to brain map regions of motor function, language function, touch sensation, hearing, vision, smell, and higher cognitive function (not including memory). Physiological processes of neural activity are measured in terms of local blood volume, flow, and oxygen saturation. But the fMRI has some limitations. First, the patient cannot move during testing, as in a regular MRI. There is no vocalization during the language testing; all the language testing is done in the head (i.e., reading a paragraph is done by reading silently, not out loud). Another limitation is that at this time patients with VNS are unable to have an fMRI because of the 3 Tesla magnet.

Practice Pearls

- The patient will need to stay still in an enclosed area during the length of the test, which can be long. Patients with chronic pain may need to discuss this issue with their pain management physician. The time of the test depends on how tests are ordered; physicians can order up to four or more tests. Ask your fMRI department for the length of time.
- Patients need to have a long attention span. Combined testing may take a little more than 1 hour.
- Test results may take a week to be returned.

PET Scan

The PET scan is a mildly invasive test that looks for metabolic changes within the brain. An intravenous catheter is used to give the necessary glucose-based radioisotope for the test, usually using fluoro-2-deoxyglucose (FDG) (Maudgil, 2003). The test is looking for interictal glucose metabolism changes (hypometabolism) to indicate a seizure focus. The PET scan technicians will need to know if the patient has diabetes prior to the test because of the use of a glucose-based radioisotope. Adjustments will need to be made to the patient's routine diabetic treatment before and after the test to prevent diabetic complications (**Level 3**; Maudgil, 2003). The patient must not have eaten or drunk anything at least 4 hours prior to the PET scan. This is to avoid sugar intake that could alter the test results.

There is controversy over the use of EEG with the PET scan. EEG can be used before and during the PET, focusing on the uptake period of the FDG to make sure that no seizure occurred that could alter the results. However, there are several major epilepsy centers that currently do not routinely order EEG with a PET scan. If the patient is unable to know when he or she is experiencing a seizure, then an EEG with PET should be scheduled. No published information is presently available to guide centers in setting best practice in this area, and further discussion is warranted.

Practice Pearls

- Prior to the PET, educate the patient on avoiding exercise the night before and the morning of the PET. If the patient exercises, the FDG will enter the muscles and not focus in the brain.
- Educate the patient not to have eaten or drunk anything 4 hours prior to the PET scan. However the patient needs to take his or her medications with water prior to the PET.
- Try to schedule the patient for the PET scan in the morning. A PET with EEG may take approximately 3 hours. PET scan without EEG may take 2 hours but this depends on the facility.
- Notify the EEG department to coordinate the schedule with the PET date and time, if the EEG is scheduled to be completed with PET.
- Be aware that if the EEG is scheduled with the PET, the EEG technicians will need to apply the scalp electrodes. The EEG technician may need to run approximately 20 minutes of EEG prior to the injection of the FDG. Have the patient come to the PET scan department approximately 30 minutes prior to the scheduled time of the PET.

SPECT Scan

The SPECT scan can be done in two different settings. It is a mildly invasive test looking for perfusion changes during an ictal phase and during an interictal phase. Both phases use a radioisotope called technetium-99 (Maudgil, 2003). The ictal SPECT scan is often done while the patient is in the EMU because of the propensity for seizures. Having the ictal SPECT performed in the EMU allows for safe reduction of AED(s), monitoring of the EEG during the injection phase of the ictal SPECT, and the safe reinstating of the AED after the procedure. The technetium-99 is injected at the very beginning of the seizure activity. The brain is then scanned looking for hyperperfusion. The interictal SPECT scan may be

done with EEG monitoring as an outpatient procedure. For this part of the test, the patient has no reduction of medication. The technetium-99 is injected while there is no seizure activity per EEG recording. The brain is then scanned looking for hypoperfusion. The two scans are then put through a process of subtraction to indicate the location of the seizure focus.

There are epilepsy centers throughout the United States that have the ictal SPECT scan performed by qualified registered nurses (RN), but not all centers have this capability. State boards of nursing and nurse practice acts may restrict RNs from performing ictal SPECT. Physicians are able to perform ictal SPECT as long as they meet their facilities' requirements. Advanced practice nurses also need to be familiar with their state's legislation regarding their ability to perform ictal SPECT as they may or may not be able to perform it in states where RNs are restricted.

Practice Pearls

- Prior to developing protocols for the RN to administer technetium-99, contact the state board of nursing to evaluate if this is covered in the state nurse practice act. If approval is given, the facility must meet and a policy and procedure for the injection for ictal SPECT in the EMU and yearly radiation education.
- Whether a physician or an RN injects the technetium-99, check to make sure that the room being used for ictal SPECT and the person injecting meet the facility's regulations and possible other radiation regulations.
- Consider reducing AEDs prior to ictal SPECT and admission into the EMU. This may be necessary to encourage seizure activity for injection.
- Educate the patient on procedures and radiation precautions set up by the facility. Basic radiation safety education may include keeping the room door closed at all times, having no pregnant or nursing women around the patient for at least 24 hours, and using standard precautions.
- Educate the EMU staff regarding the use of radiation and precautions to use in case of a radiation spill.
- Use a Geiger counter to check for potential spills in the room of the ictal SPECT when the patient leaves to go to the SPECT scan. This is very important. Radiation spills that are detected should be handled per facility policy prior to the patient and others returning to the room.
- Make sure there is a radiation book with all the precautions and instructions in the EMU, especially when the ictal SPECT is occurring.

MEG

The MEG is noninvasive neuroimaging that detects, analyzes, and notes the interruptions in the magnetic field by electrical activity in the brain captured at hundreds of points around the head in snapshots. This is a relatively new imaging technique for the epilepsy patient that looks at neuronal activity within the brain. In a quantitative way, tomographic images of the electrical current density in the brain can be extracted from each snapshot of the MEG signal, allowing identification of superficial and deep data in the form of tomographic images. The MEG must have spikes from the scalp EEG in order for the testing to occur. The test allows for the variability in a single area to be seen in the context of activity in other areas and background rhythmic activity (Ioannides, 2006).

Practice Pearls

- The patient will need to have an MRI prior to the MEG.
- A copy of actual scalp electrode recording may be beneficial to the physician reading the MEG.
- The patient will need to be able to tolerate scalp electrodes on the head while the head is placed in the MEG machine. The patient is usually in a sitting position.

Wada Test

The Wada test, or intracarotid amobarbital procedure, is an invasive test used to localize the language and memory. Developed by Dr. Juhn Wada, it has been the gold standard for lateralization of language dominance before epilepsy surgery (Abou-Khalil, 2007). Informed consent needs to be obtained prior to the Wada test. Scalp electrodes are placed to monitor the brain waves during the test. An angiographic catheter is inserted via the groin by the neuroradiologist. When this catheter reaches the carotid arteries, location is checked within the brain. Then amobarbital is injected in the carotid arteries one at a time for hemispheric anesthesia testing of spontaneous speech, counting, comprehension, naming, repetition, reading, and memory. Once both sides have been tested, the catheter is removed and a pressure dressing is applied to the catheter site. The nurse should carefully monitor the patient for complications for approximately 6 hours after the angiogram (**Level 3**; Trenerry & Loring, 2005). Once the patient is cleared to leave by the physician, the patient is able to leave with a less bulky pressure dressing. The results of the Wada test are analyzed and placed with the results of all the other tests to determine whether proceeding to a resection would be beneficial for the patient.

Because of the risks of this invasive procedure, alternatives to the Wada test are being considered and developed, including fMRI, Owater PET, and transcranial Doppler.

Practice Pearls

- The patient will need to have labs drawn no later than the day before the Wada test. A complete blood count, comprehensive metabolic panel, prothrombin time, and partial thromboplastin time are usually obtained.
- The day before the Wada test the patient will need to have a baseline pre-Wada test for comparison after the Wada test.
- An MRI will be needed for the Wada test.
- Schedule the Wada test in the early morning. The actual Wada test takes approximately 2 hours but the postprocedure time is approximately 6 hours because of the need to keep the angiogram leg straight with a pressure dressing, but this depends upon the facility's time frame.
- A family member needs to be at the facility while the patient undergoes the procedure.
- The patient needs to not have eaten or drunk anything after midnight the night before the Wada test, but can take his or her medication with sips of

water prior to the Wada test.

Neuropsychological Testing

Neuropsychological testing is noninvasive and can be performed both before and after an epilepsy surgery. Standardized tests are used to identify difficulties with memory, language, IQ (verbal and performance), and quality of life. Results of the neuropsychological testing can also identify potential postsurgical problems, such as the potential for cognitive dysfunction and memory loss.

Practice Pearls

- The results may be used to develop a plan for problems that are identified. They may also help identify potential postresection difficulties.
- The time of the testing is approximately 6–8 hours.

EMU Admission

The EMU admission can be for either noninvasive or invasive testing. There are many purposes for the EMU, including, but not limited to, classifying, diagnosing, and localizing epilepsy. This is accomplished by inpatient 24-hour video/EEG monitoring in a controlled and safe environment.

Consent

Consent forms need to be signed upon admission. Some of these consent forms may include:

- Permission to monitor with video 24 hours a day
- Permission to use the video/EEG monitoring inside the facility for teaching purposes
- Permission to use the video/EEG monitoring outside the facility for teaching purposes

Nursing Assessment

At present, there is no national standard recommendation for frequency of nursing assessment and monitoring of the patient in the EMU, and this may vary by institution. It is currently based on individual patient need. (American Association of Neuroscience Nurses [AANN's] Epilepsy Special Focus Group is presently examining this issue, which requires further recommendation and standardization.)

Monitoring

The noninvasive monitoring procedure in the EMU includes scalp electrode video/EEG. The physician will decide whether medications should be reduced prior to the EMU or while the patient is in the EMU to help encourage seizure activity

and avoid the chances of status epilepticus. As stated earlier, this is seizure activity that is prolonged, without a return to baseline. It may appear that the seizure activity is continuous. This is a medical emergency. Each institution has their own policies and procedures concerning the care of the patient during status epilepticus. For rescue suggestions, see the discussion of status epilepticus on p. 8 of the original guideline document.

The selection of the montage and the number of contacts particular to the patient's symptoms is geared to gathering information for the physician. The video augments the EEG by correlating the physical activity with the presence or absence of EEG changes. There are many invasive monitoring procedures for the EMU. Some of the more common include:

- Sphenoidals
- Depths
- Strips
- Grids

1. Sphenoidals are electrodes that can be placed bilaterally in the upper cheek area at bedside in the EMU. They are used to assess the foramen ovale and mesial aspects of the temporal lobe for ictal activity. The sphenoidals are more sensitive and can show a higher amplitude in these areas than scalp electrodes.
2. Depth electrodes are placed in the operating room (OR) through burr holes in the cranium for intracranial EEG monitoring. The neurosurgeon can place one or more sterile depths with multiple contacts approximately 3–5 mm wide in a 0.8 mm tube (Figure 2 in the original guideline document). These are used to monitor electrical activity near the hippocampus and mesial structures of the temporal, frontal, and occipital lobes. Often, depth electrodes are placed bilaterally into the temporal lobe. On other occasions, depths are used with subdural grids to augment the monitoring information. The neurosurgeon or the EMU attending physician can remove these depths at the bedside prior to discharge under sterile conditions. If there is any difficulty in removing the depths or depths are in combination with strips, the patient will need to return to the OR to have the depths removed.
3. Strips are made of sterile flexible clear material compatible with the cerebral cortex with eight numbered electrode contacts per row. There are usually no more than two rows per strip. In the OR, the neurosurgeon can place one strip or multiple strips in different areas directly on the dura or the cerebral cortex through one or more burr holes. The placement of strips is determined by the results of previous recording and results of diagnostic tests. The strips are more sensitive than scalp electrodes and are used to sample ictal onset for possible grid placement or a lobectomy. To remove the strips, the neurosurgeon will return the patient to the OR.
4. Subdural grids have two or more rows of eight electrode contacts that can have as many as 64 electrode contacts on a given grid (Figure 3 in the original guideline document). These grids are placed on the cerebral cortex by a craniotomy and can be used both to capture electrical activity as well as for cortical stimulation mapping of the cerebral cortex (Figure 4 in the original guideline document). This allows the surgeon to tailor a resection, sparing eloquent cortex such as speech and memory and avoiding motor centers.

Cortical stimulation or mapping with the grid can be done either at bedside in the EMU or in the OR while the patient is awake. Milliamps of stimulation are used to determine if function exists between a pair of electrodes. The two most commonly requested functional maps are motor and language mapping. Motor mapping includes both primary and secondary areas. Language mapping is accomplished by measures such as spontaneous speech, token test, paragraph reading, and Boston naming. These maps focus primarily on the temporal and frontal lobes. The parietal and occipital lobes also have special tests for mapping these complicated lobes.

Identifying functions such as Broca area and the motor strip will give physicians vital information on whether to proceed with a surgery, such as a lobectomy, or develop another plan of care. Physicians do not want to surgically remove a seizure focus that would also remove speech, motor function, or any other vital function necessary for the daily life of the patient. To this end, the patient may not be able to undergo resective surgery. In both instances, medical management would be the follow-up course of treatment.

Practice Pearls

- Concerning consent forms, have your facility consult with your legal staff to make sure that Health Insurance Portability and Accountability ACT (HIPAA) regulations are met.
- Have the referring physician address AED reduction prior to the EMU admission.
- Make sure that EMU rooms include at least suction, oxygen with nonbreather masks, seizure pads for the upper side rails, a softer special type of flooring, seizure and call buttons in the room and bathroom, and a fold-away bed for the adult family member staying with the patient.
- Ask an adult family member to stay with the patient to assist in identifying ictal activity.
- Have patients bring shirts and night clothes that do not need to be placed over the head. Encourage patients to bring games, books, and other things that will occupy them without interfering with the EEG.
- Encourage patients to ambulate in the room. (If the surgical patient is dizzy then the patient should ask for assistance to the bathroom.) Ambulation is encouraged to decrease postoperative complications such as pneumonia and deep vein thrombosis.
- Implement the Falls Precaution policy of your facility. If the patient has a helmet, he or she should bring this to the EMU.
- Watch EMU monitors around the clock.
- With each episode, whether it's witnessed or suspected, patients should be assessed in their room by at least one EMU staff member. Assess for at least consciousness, alertness, awareness, memory, safety, and return to baseline. This should be documented in the patient's chart.
- Conduct routine assessment of nonsurgical and surgical patients, including vital signs, per the facility's policy and procedure.
- Use sterile gloves if the patient with depths, strips, and grids needs to have the dressing changed or the electrode wires need to be checked. Insist on good hand-washing, even with the family members and people visiting the patient, to prevent infection with patient who has depths, strips, or grids.
- Have the EMU nurse make rounds with the EMU attending physician each day

to hear the plan for each patient and the new orders for the day.
- Explain changes in medication to the patient.
- At discharge, teach the patient the proper titration and side effects of the AED(s) that are being given at the time of discharge.
- Encourage a follow-up appointment with the referring physician to discuss the plan of care.

Surgical Management

1. Surgical Options

   Surgical options will depend on the results of medication control and test results. First, intractability must be established. If a seizure focus has been identified and the results of testing are concordant—and there is a low potential for postoperative deficits—a lobectomy would be considered. The temporal lobectomy is the most common resection. The results of the Wada test and additional information from depth electrodes and neuropsychological testing would provide information whether an amygdalohippocampectomy or hippocampectomy might be included with the temporal lobectomy in order to spare memory. Extratemporal resection may occur with or without invasive monitoring. Focal resections for lesionectomy can be considered in the presence of benign tumors, cavernomas, or arteriovenous malformations. If the epilepsy is nonlesional, and the EEG is suggestive of lateralization to one lobe or hemisphere, invasive monitoring is often used to better localize the seizure focus. In children with catastrophic epilepsy in the setting of malformations of cortical development, hemimegalencephaly, Sturge-Weber syndrome, Rasmussen encephalitis, or perinatal stroke, a hemispherectomy might be the most prudent course of action and afford the child the best opportunity for reducing seizure burden.

   The reduction of AEDs after resective epilepsy surgery is considered on an individual basis. There is currently no standard method to determine seizure efficacy once AEDs have been discontinued postoperatively. There are a number of research articles currently available to give guidance concerning this issue (e.g., Berg et al., 2006; Kim et al., 2005; Schmidt, Baumgartner, & Loscher, 2004).

   A corpus callosectomy is a procedure that disconnects the hemispheres by sectioning the corpus callosum to prevent seizures from spreading from one hemisphere to the other. It is not routinely performed. This procedure can reduce the risk of seizure-related injury to patients with atonic seizures or drop attacks or who repeatedly injure themselves seriously. This surgical option is not used unless medically necessary because of potential recovery deficits.

2. The Vagus Nerve Stimulator (VNS)

   The VNS is another surgical option for epilepsy patients who are not candidates for lobectomy. The VNS is placed transcutaneously in the OR. The generator is typically implanted in the left upper chest under the clavicle while

the leads are wrapped around the left vagus nerve. The device works by sending mild electrical impulses to the vagus nerve, which in turn sends signals to the brain. The intensity and duration of impulses is determined by the practitioner, and is often programmed during an outpatient visit. During stimulation patients may experience hoarseness, a deeper tone of voice, or a buzzing sensation. Although not recommended, the patient can suspend the stimulus by taping the magnet over the generator to decrease the "buzzing" feeling during sleep (Cyberonics Vagus Nerve Therapy, 2005).

The settings can be adjusted to limit side effects or assist the patient to gain better seizure control. A magnet is provided that can be used to swipe the generator during an aura. (By swiping the generator, the stimulus will be turned on for a longer period of time.) The VNS can be turned off by healthcare professionals with a special "wand" or by taping the magnet over the device. Taping the magnet over the device is recommended if the patient experiences adverse effects at home, or if there is a need to temporarily suspend the device (e.g., if the patient is singing; **Level 3**; Cyberonics Vagus Nerve Therapy, 2005; VNS Therapy Patient Essentials: Epilepsy, 2005). When a patient needs to have an MRI, the output current of the VNS should be turned off by a trained professional and then reinitiated after the procedure so as not to disrupt the patient's VNS settings and cause serious damage to the VNS and the patient (**Level 3**; Cyberonics Vagus Nerve Therapy). As technology is frequently changing, healthcare professionals should contact the VNS manufacturer to discuss the specifics concerning MRI procedures in patients with a VNS.

3. More Research Needed

   Gamma knife non-lesional epilepsy surgeries are not currently performed on a routine basis. There has been success with this therapy for tumor patients, but there is more to learn about this surgical option for non-lesions. Hopefully more research will help determine if this is a successful option for epilepsy patients, particularly those who have "failed" prior surgical intervention or who would prefer intervention without a craniotomy.

Practice Pearls

- Despite going through all the different tests to undergo surgery for the control of intractable epilepsy, the patient may be reluctant to continue with surgery. Encourage the patient to elaborate on reasons for reluctance.
- Encourage patients to speak to other patients who have undergone the same type of surgery.
- If the patient decides not to go through with surgery, work with the physician and multidisciplinary team to develop another plan of care. (This is most often an elective surgery.)
- After clearance by the neurosurgeon (which takes approximately 4 weeks), suggest to postoperative epilepsy patients who plan to return to work that they work part-time for the first 2 weeks before going back to a full-time schedule. This will help prevent fatigue and headaches that may occur following surgery.

Experimental Treatments

1. Medical Options

   There is ongoing research to help improve the lives of epilepsy patients. Numerous potential medications are in various phases of study, both preclinical and clinical.

2. Surgical Options

   An implantation device called the NeuroPace (Responsive Neurostimulator) is also being investigated. The NeuroPace is designed to detect abnormal electrical activity in the brain and respond by delivering electrical stimulation to normalized brain activity before the patient experiences seizure symptoms (www.NeuroPace.com). These ongoing research efforts reflect the common goal of healthcare professionals and industry to give epilepsy patients hope for a better quality of life.

3. Nonsurgical Options

   Nonsurgical options include different diets in addition to the daily AEDs. The ketogenic diet has been utilized in the pediatric population with some success (Buelow et al., 2004; Epilepsy Foundation of America [EFA], 2005). Presently some investigators and institutions are evaluating its effects on adults with epilepsy. The theory behind this diet is based on producing ketoacidosis, which has antiseizure properties. Other diets such as the Atkins Diet, which also put the body into ketosis, are currently being researched for their effectiveness.

Expected Outcomes

The goal of management of all people with epilepsy is to attain seizure-free status, with no or minimal side effects of therapy. In addition, the patient will remain free from injury and be empowered to meet individually defined goals. Through holistic approaches to patient care, nurses assist patients and families to achieve and maintain a high level of function and high quality of life. With proper knowledge, nurses involved in the management of patients with epilepsy can provide valuable assistance to improve the quality care provided to patients with this condition.

Education

Patient and Family Education

Patient and family education focuses on prevention f seizures, patient safety, and quality-of-life issues. The clinician and patient must establish mutually acceptable goals regarding treatment.

Medications

It is the clinician's responsibility to ensure that patients and family members understand the importance of medication adherence, drug interactions, and short- and long-term adverse effects. Often patients may not remember names of previously prescribed drugs or dosages, and pictures may be of help in aiding medication identification. A table of both old and new antiepileptic drugs and dosages in picture form that clinicians may find useful in assessment and teaching is included in the pamphlet *Current Options in Antiepileptic Drug Therapy*, available free of charge from Ortho-McNeil Neurologics (800/526-7736).

The clinician and patient should develop a strategy to incorporate medications into the patient's daily routine. The clinician should provide information on how to intervene if there are medication-related challenges. Additionally, practitioners need to educate patients on how to prevent potential adverse effects. Examples of this include proper dental hygiene for patients on medications that affect dental health, weight-reduction options for those on medications that cause weight gain, and increased water intake for patients taking medications associated with kidney stones. Bone health interventions such as smoking cessation, weight-bearing exercises, reduced alcohol intake, and calcium/vitamin D supplements can be recommended to reduce the risk of osteomalacia (**Level 3**; National Institutes of Health Osteoporosis and Related Bone Diseases-National Resource Center, 2006). The specific dose of calcium and vitamin D for patients with epilepsy has not been established.

Factors that lower seizure threshold should be discussed, including sleep deprivation; poor diet, exercise, alcohol consumption; and physical, emotional, and mental stressors that trigger seizure recurrence (**Level 3**; Buelow et al., 2004).

Women of Childbearing Age

Women with epilepsy (WWE) are challenged with additional needs related to patient education. All women of childbearing age should be informed of the importance of prenatal care. Women should be aware of potential major and minor teratogenicity associated with their specific AED. They should also know that preconception and gestational administration of folic acid may reduce the risk of birth defects. Because half of all pregnancies are unplanned (Finer & Henshaw, 2006), all WWE taking AEDs should consistently take folic acid. The American Academy of Neurology Practice Guidelines recommend 0.4–4 mg daily (**Level 3**; American Academy of Neurology, 1998). Some experts recommend that all women of childbearing age taking AEDs receive 4–5 mg of supplemental folate. However, this recommendation is not based on prospective trials in WWE (**Level 3**; Wilson et al., 2003).

There is no "drug of choice" for women of childbearing age. In general, the recommended AED is one that works best in terms of efficacy and tolerability for each individual. The older AEDs may have a higher risk of birth anomalies. Fetal death or major congenital malformation occurred in 20% of patients taking valproate, 11% taking phenytoin, 8% taking carbamazepine, and 1% taking lamotrigine (**Level 2**; Meador et al., 2006). Although this is clinically helpful, it is important to note that WWE may be required to take the older medications, particularly if newer alternatives have failed them.

AEDs and Pregnancy

Women with epilepsy should be informed of the need to maintain their AED regimen once they become pregnant. Reducing or discontinuing AEDs during pregnancy increases the risk of seizures, which can be harmful. The benefit of breast-feeding should also be discussed. Women should know that, in general, it is safe to breast-feed. Additionally, postpartum safety interventions should be emphasized to reduce the risk of newborn injury (EFA, 2003). Women should be informed of potential drug interactions between enzyme-inducing AEDs and oral contraceptives, as well as the potential effects of oral contraceptives on certain AEDs (**Level 3**; Buelow et al., 2004; Sabers et al., 2001). Table 2 in the original guideline document summarizes the effects of AEDs on oral contraceptives. Although the effects of AEDs on alternative forms of contraceptives in WWE have not been established, oral contraceptives may lower the concentration of lamotrigine (**Level 3**; Sabers et al, 2001.)

The Knowledge of Women's Issues and Epilepsy (KOWIE) I & II were developed to assess what WWE (KOWIE-I) and healthcare professionals (KOWIE II) know about issues specific to women. Both questionnaires are valid and reliable (**Level 3**; Long et al., 2005) and can be used to evaluate the knowledge of female issues and epilepsy and help guide educational interventions.

Educating Families and Caregivers

Parents should be educated about the lack of evidence for use of antipyretic medication in the prevention of recurrent febrile seizure in children with a prior history of febrile seizure (**Level 2**; Uhari et al., 1995; van Stuijvenberg et al., 1998; Warden et al., 2003). Family members should be trained in appropriate first aid measures as recurrence rates are noted to be up to 40% in children. First aid measures include keeping the patient safe, loosening tight clothing around the neck, protecting the head, and turning the person on his or her side. A handout for seizure first aid is available from the Epilepsy Foundation of America Web site at www.epilepsyfoundation.org/about/firstaid/seizurefachart.cfm. The observer should not place objects in the patient's mouth or administer liquids. In addition, caregivers should not restrain the patient (**Level 3**; EFA, "First aid," 2007).

Caregivers should be informed of environmental changes in the home or workplace that can reduce the risk of injury. Knowing when to call for assistance and transport to a healthcare facility can also improve outcomes. Under certain conditions, mortality and morbidity are increased following a seizure. Individuals and families should be instructed to call emergency medical services or go to the emergency department for the following situations:

- A seizure lasting longer than 5 minutes
- A seizure occurring in water due to potential cardiac and pulmonary problems
- Injury
- Physical distress
- History of diabetes
- Pregnancy
- Repeated seizures without return of consciousness between them
- A first seizure with no history of epilepsy

- Anytime a caregiver is concerned (**Level 3**; EFA, "Is an emergency room visit needed?", 2007)

Psychosocial Issues

PWE should be informed of relevant psychosocial issues, including state driving laws, and resources supporting employment and education for patients with disabilities (**Level 3**; Buelow et al., 2004). Safety information related to extracurricular activities and sports should be articulated prior to engaging in these interests. For example, PWE should wear helmets when necessary and avoid dehydration and overexertion (**Level 3**; Buelow et al.; Spitz, 1998).

Providing names of contacts for local support groups, social services, vocational training programs, community resources, and various foundations can assist with emotional and psychological stress for patients and caregivers living with epilepsy. Unfortunately, there is still a perceived stigma associated with the diagnosis of epilepsy. Providing social support and resources can minimize feelings of isolation, poor self-esteem, and other related challenges (**Level 3**; Buelow et al., 2004; EFA, "Finding support," 2007). Being able to express fears, concerns, frustrations, and anger is frequently helpful.

It is also important to provide factual and realistic information to clarify misconceptions. Maintenance of a diary with information about seizure characteristics such as duration and presentation, medications, menstrual cycle, physical exertion, sleep patterns, episodes of increased stress, use of alcohol, and other daily activities that might affect the timing of seizures is often helpful to the individual (**Level 3**; Buelow, et al., 2004; EFA, "Recognizing seizure triggers," 2007). Wearing a medical identification band or necklace can also alert others to call for help should they observe an individual having a seizure.

Practice Pearls

- Provide patient education as part of every patient interaction. Continuous assessment and intervention is mandatory to promote self-advocacy in patients and families with epilepsy.
- Contact agencies to help patients deal with problems pertaining to issues such as anxiety, insurance difficulties, transportation, obtaining medication, applying for disability, and fighting discrimination

Definitions:

Data Quality Classification

Class I: Randomized controlled trial without significant limitations or meta-analysis

Class II: Randomized controlled trial with important limitations (e.g., methodological flaws, inconsistent results); observational study (e.g., cohort, case control)

Class III: Qualitative study, case study, or series

Class IV: Evidence from reports of expert committees and/or expert opinion of the guideline panel, standards of care, and clinical protocols that have been identified

Levels of Recommendation

Level 1: Recommendations are supported by class I evidence.

Level 2: Recommendations are supported by class II evidence.

Level 3: Recommendations are supported by class III and class IV evidence.

CLINICAL ALGORITHM(S)

A *Seizure Assessment Algorithm* is provided in the original guideline document.

EVIDENCE SUPPORTING THE RECOMMENDATIONS

REFERENCES SUPPORTING THE RECOMMENDATIONS

References open in a new window

TYPE OF EVIDENCE SUPPORTING THE RECOMMENDATIONS

The type of supporting evidence is identified and graded for selected recommendations (see the "Major Recommendations" field).

BENEFITS/HARMS OF IMPLEMENTING THE GUIDELINE RECOMMENDATIONS

POTENTIAL BENEFITS

Optimization of patient outcomes

POTENTIAL HARMS

- Potential side effects and drug interactions of antiepileptic drugs (AEDs), including Stevens-Johnson syndrome and cognitive dysfunction
- Perioperative and postoperative complications of surgical procedures
- Potential recovery deficits following corpus callosectomy
- Complications from the Wada test

Pregnant Women

Risk of fetal death or birth anomalies from AEDs

QUALIFYING STATEMENTS

QUALIFYING STATEMENTS

- The author, editors, and publisher of this document neither represent nor guarantee that the practices described herein will, if followed, ensure safe and effective patient care. The authors, editors, and publisher further assume no liability or responsibility in connection with any information or recommendations contained in this document. These recommendations reflect the American Association of Neuroscience Nurses' judgment regarding the state of general knowledge and practice in their field as of the date of publication and are subject to change based on the availability of new scientific information.
- This reference is an essential resource for neuroscience nurses responsible for the care of this patient population with a multitude of biopsychosocial needs. This guide is not intended to replace formal learning, but rather to augment the knowledge base of clinicians and provide a readily available reference tool.

IMPLEMENTATION OF THE GUIDELINE

DESCRIPTION OF IMPLEMENTATION STRATEGY

An implementation strategy was not provided.

IMPLEMENTATION TOOLS

Clinical Algorithm

For information about availability, see the "Availability of Companion Documents" and "Patient Resources" fields below.

INSTITUTE OF MEDICINE (IOM) NATIONAL HEALTHCARE QUALITY REPORT CATEGORIES

IOM CARE NEED

Getting Better
Living with Illness

IOM DOMAIN

Effectiveness
Patient-centeredness

IDENTIFYING INFORMATION AND AVAILABILITY

BIBLIOGRAPHIC SOURCE(S)

American Association of Neuroscience Nurses. Care of the patient with seizures. 2nd ed. Glenview (IL): American Association of Neuroscience Nurses; 2007. 23 p. [152 references]

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FINANCIAL DISCLOSURES/CONFLICTS OF INTEREST

The American Association of Neuroscience Nurses (AANN) requires that all planners, teachers, and authors involved in CNE make full disclosure indicating whether the individual and/or his/her family have any **relevant financial relationships**, now or within the 12 months preceding this event, with a commercial interest (e.g., pharmaceutical companies, biomedical device manufacturers, and/or corporations) whose products or services are discussed in the continuing education activity content over which the individual has control. All presenters participating in the AANN sponsored programs must complete this form and return it as indicated. All information disclosed is printed in the program materials.

The authors state no potential conflicts of interest.

GUIDELINE STATUS

This is the current release of the guideline.

GUIDELINE AVAILABILITY

Electronic copies: Available from the American Association of Neuroscience Nurses Web site.

Print copies: Available from the American Association of Neuroscience Nurses, 4700 W. Lake Ave., Glenview, IL 60025.

AVAILABILITY OF COMPANION DOCUMENTS

None available

PATIENT RESOURCES

None available

NGC STATUS

This NGC summary was completed by ECRI Institute on September 8, 2009. The information was verified by the guideline developer on September 29, 2009.

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